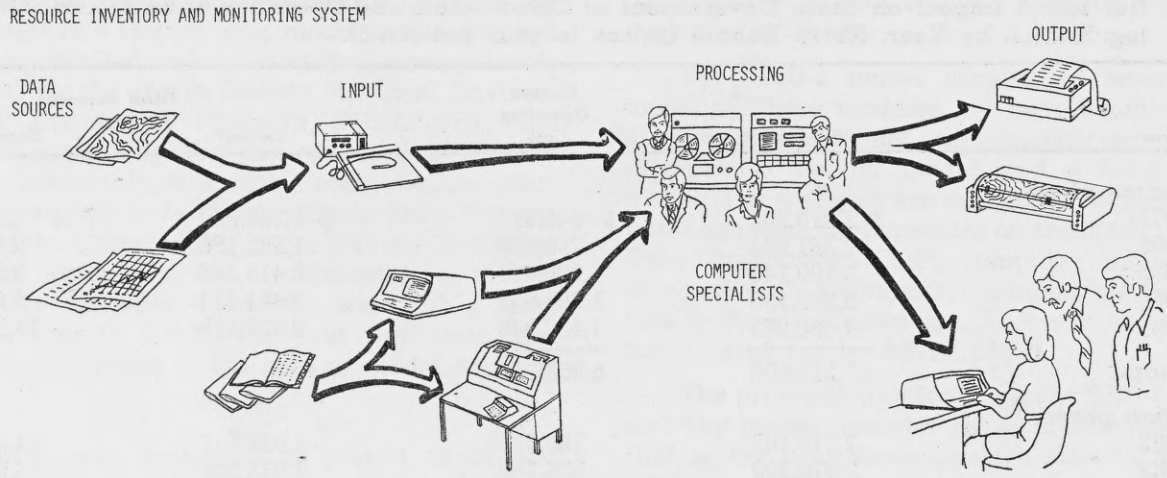

Figure 1. Graphic display of the RIMS system.

Resource Inventory, Information Management and Monitoring System

William C. Nelson and Jerome E. Johnson

Rapidly changing uses of land and other resources has brought forth new problems for public officials and citizens to solve. Often they have turned to the research experts of the North Dakota Agricultural Experiment Station for the detailed data or interpretations of detailed data to better analyze their problems. Frequently these resource specialists have to examine extensive collections of information to provide detailed interpretations to meet the users' needs. For these reasons, the North Dakota Agricultural Experiment Station in September, 1972, developed a research project to create a Resource Inventory, Information Management, and Monitoring System (RIMS).

RIMS is a computerized data system for North Dakota and will provide detailed and interpretive natural resource information. In its four years of organized existence, the RIMS team has considered the many aspects of developing a computerized data base and the equipment, programs and personnel needed. Already, some of the needed equipment and programs have been obtained or created; and experienced computer specialists who are research-oriented have been at work developing a data base and many models to utilize data base information to solve resource problems.

RIMS consists of a set of techniques for recording, storing, processing, recalling, and displaying information from a computerized resource inventory. Recording mapped information involves the use of a digitizer, which transforms lines on maps into a computer storable form. A digitizer operator traces all the lines on the map, which are then converted to x and y coordinates. Each set of data is assigned a number for access and control of its use. These data are then processed on the IBM 360/50 computer by programs designed by the RIMS system analyst/programmer. Each data item is identified by state plane coordinates and stored on magnetic tape for future use. Data can then be retrieved and maps displayed on the NCR 796-201 video terminal, or printed on the NCR 260 terminals, the IBM 360/50 printer or the IBM 1620 drum plotter.

The North Dakota Agricultural Experiment Station has supplied RIMS with a Graf/Pen digitizer, Model GP-2, and a digitizer operator who has been transforming maps since January, 1975. All North Dakota soils maps have been digitized and the processed data stored on magnetic tape. In June, 1974, the Agricultural Experiment Station acquired three NCR 260-6 cassette terminals and one NCR 796-201 video display terminal for displaying the computer-generated maps.

Another Graf/Pen digitizer, Model GP-3, has been acquired and another digitizer operator hired to assist in entering additional data into the computerized data bank.

Soils—Early Emphasis

Soil is a natural environmental body that is a product of the influence of climate and living organisms upon parent material. Properties of the soil provide a record of the environment in which that kind of soil developed and the landscape position which it occupies. Interpretation of soil properties provides essential information for land-

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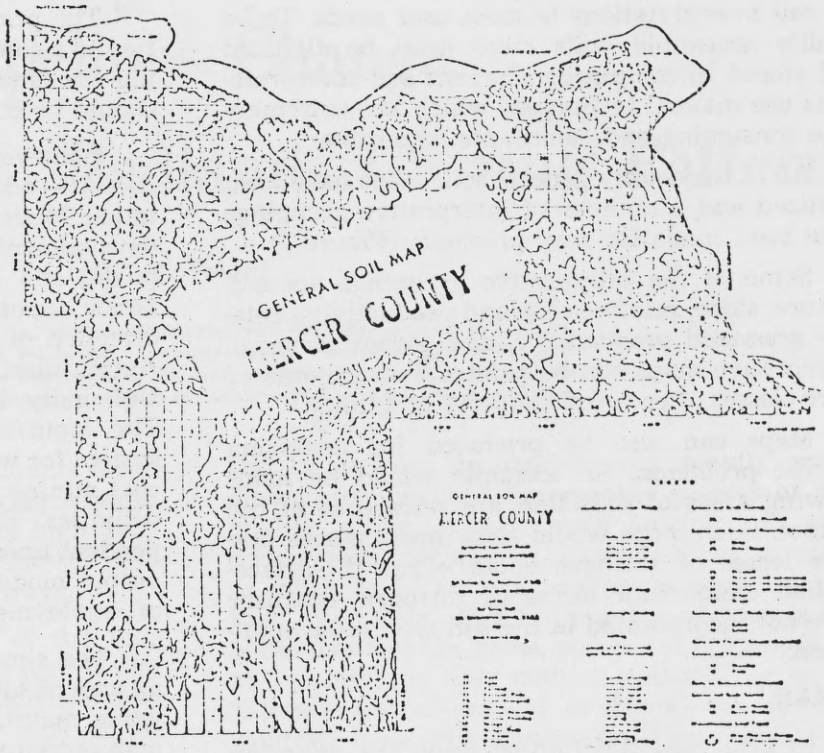
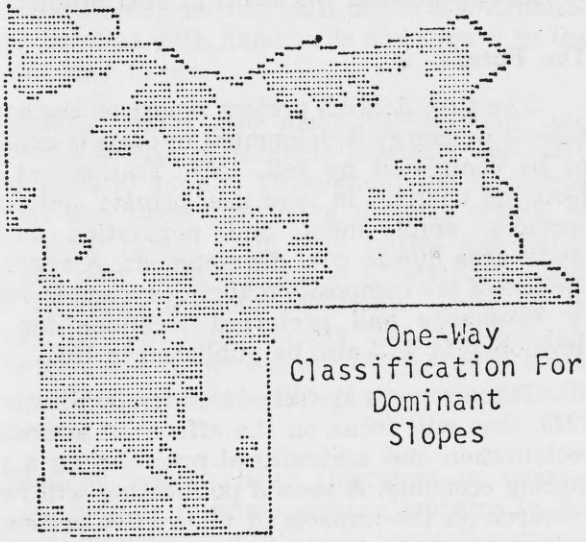


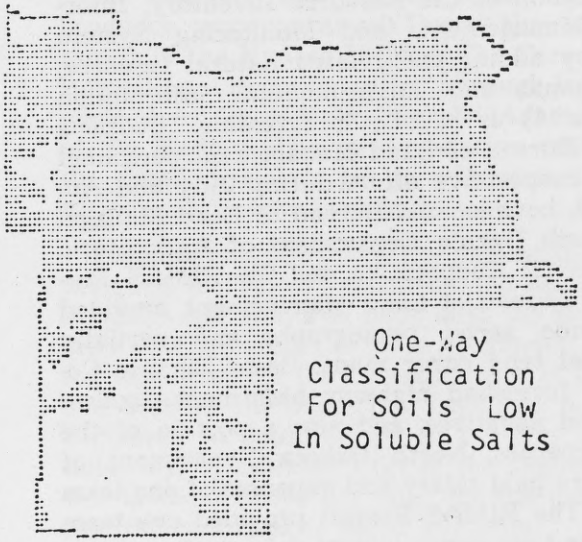
Examples of Computerized Maps Printed From Digitized Data Input

INTERPRETED
DOMINANT SLOPES



One-Way Classification For Dominant Slopes

INTERPRETED
LOW IN SOLUBLE SALTS



One-Way Classification For Soils Low In Soluble Salts

Figure 2. Examples of Computerized Maps Printed from Digitized Data Input.

use planning, environmental studies, suitability of use, regional development, and many other uses.

Soil data must be readily accessible to allow for soil interpretations to meet user needs. To be readily accessible, soils maps must be digitized and stored in computers. Current soil interpretations use manual techniques which are extremely time consuming and, hence, are expensive.

All of the county general soils maps have been digitized and a number of interpretive groupings have been made for map printouts (Figure 2).

Some of the interpretive groupings are soil texture, slope, relative cropland productivity, relative grassland productivity, and parent material. Interpretive maps can be printed showing one or more classes of each soil property or quality.

Maps can also be produced for analyzing specific problems. An example would be maps showing areas of soils that are calcareous at the surface. Such maps would show areas where possible losses of nitrogen could occur if surface-applied ammonium forms of nitrogen fertilizer were not incorporated in the soil soon after application.

RIMAS

In 1975, the RIMS effort drew the attention of the Cooperative States Research Service (CSRS), which was administering Environmental Protection Agency funds for energy development research. A new project, Resource Inventory, Monitoring and Analysis System (RIMAS), was developed to evaluate impacts of lignite development in western North Dakota and was funded by CSRS in 1976.

Expansion of the Resource Inventory, Information Management, and Monitoring System (RIMS) by adding coal-related natural resource, socioeconomic and environmental information (Objective 1) is rapidly progressing. Contacts with the Bureau of Land Management personnel led to a cooperative effort during July and August, 1976, between the Bureau of Land Management, North Dakota Department of Agriculture, Basin Electric Cooperative and the RIMAS Project. The Bureau of Land Management provided high-altitude aerial photographs and partially categorized land cover maps. Basin Electric Cooperative furnished highway base maps, landsat photos and negatives, and also a portion of the travel expenses. North Dakota Department of Agriculture paid salary and expenses of one team member. The RIMAS Project provided one team member and assistance in organizing and performing the task. Approximately 100 square miles of land were mapped for native grassland and categorized by vegetation type (see Figure 2).

An additional 2,500 square miles of land have been mapped since September 1, 1976. This is approximately one-half of the study area.

The process of transferring the map information to a computerized form is underway. Classifying the land cover and digitizing the information should be completed within the next 6 months.

Achievement of the second objective of RIMAS—adaptation of the Sheyenne Basin Simulation Model to estimate the impacts of lignite development and to create crossover between the model and RIMS—is also progressing. The economic input/output model developed under the direction of Dr. Thor Hertsgaard, Department of Agricultural Economics, North Dakota State University, has been programmed into the model. The input/output model will provide the basic system for estimating economic changes caused by coal mining and processing and land reclamation activities. Employment and population are dependent upon economic activity, hence, the input/output model will also be used to yield estimates of employment and population changes.

The simulation model has been expanded to an area of 4,900 square miles (70 miles by 70 miles), while maintaining the one square-mile cell. The map output programs have also been rewritten to 70 by 70 cell format.

A composite mapping system has been obtained and is being put into operation. Contact has been made to obtain data on avoidance areas as defined by the North Dakota Legislature. Maps of coal leases have been obtained. Work has been initiated on refining the rationale of classifying areas on a continuum from "absolute avoidance" to "most preferred" in terms of coal mining.

The Future

The first RIMAS project report on the spatial aspects of energy development impacts is expected to be completed by fall, 1977. This report will focus on changes in land use, private and public services, employment and population in the study area due to coal development. A report on the use of the composite mapping system to identify avoidance and preferred locations for coal development will also be published in 1977.

Three reports are scheduled for publication in 1978. One will focus on the effects of alternative reclamation and agricultural practices on a post-mining economy. A second publication will report research on the impacts of alternative settlement patterns—emphasizing people transportation and public service costs. The final report will be on the impacts of energy transmission corridors on land use and the economy.